

## Innovation in concert hall design

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### ABSTRACT

This paper addresses the expectation of originality in the context of spaces for the performing arts. Following a brief review of the principal ‘Types’ of concert hall widely used as the design basis for halls in the second half of the 20<sup>th</sup> century, three examples are offered for innovative designs during this period. The need for change arose partly from the architectural need for novelty and partly in response to manifest shortcomings in the understanding of preference in the sound of the orchestra in concert spaces. In each case there was a research dimension from which the new architectural form emerged.

Keywords: Design, Research, Innovation

### 1. INTRODUCTION

There is an implicit understanding amongst many architects - and the public - that every new commission presents the opportunity for originality. This paper addresses the expectation of originality in the context of spaces for the performing arts. At the outset the owner’s decision, seldom explicit, is whether to instruct the architect to design a ‘conventional’ concert hall or not. In general however the owner has insufficient reliable information to decide. The ‘conventional wisdom’ at the time seems to have been the main factor in deciding this crucial issue. This paper recounts briefly the ‘Types’ fashionable during the past 6 decades in the Americas, Europe, and Asia:

- ‘Shoebox’ (1) The legacy of the late 19<sup>th</sup> century in Europe.
- ‘Shoe box with supplementary reverberation chambers’ (2).
- ‘Vineyard’ (3,4,5) Hans Scharoun’s ‘60s masterpiece in Berlin is the origin of numerous derivative halls of variable success.
- ‘Fans’(6) Since the discovery of the role of lateral reflected sound these halls with form dictated by the view of the stage have largely disappeared.
- ‘Directed reflection halls’ (7) The example chosen is the Michael Fowler Centre, NZ. Architects Warren and Mahoney, acoustician MDA, 1983.
- ‘Horse-shoe opera houses’ (8) The example is the Philadelphia Academy of Music.

These types are all illustrated in Figure 1.

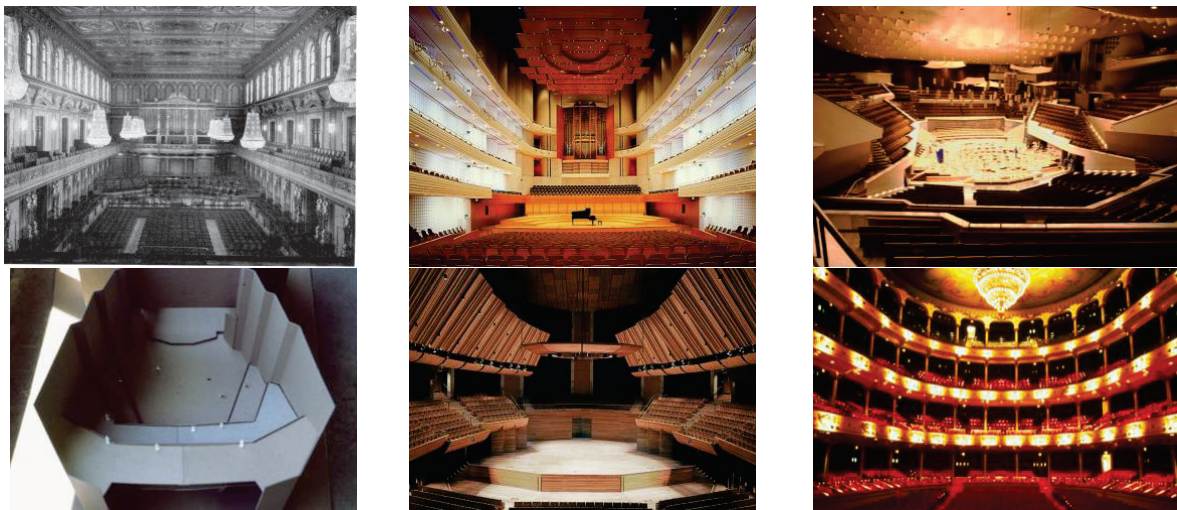


Figure 1 – Six principal ‘types’ of concert hall design

## 2. ARCHITECTURAL STATEMENT

Performing Arts buildings are often the centre-piece of an urban environment, representing the fruition of community endeavour and prestige. It is not surprising therefore that distinguished architects are either commissioned to realise them, or compete for the honour in architectural competitions. Certainly that is the case in the three examples I have chosen to discuss as well as the 'types' listed in the introduction. Each of these buildings makes a strong architectural statement irrespective of whether there is acoustical novelty in the design or not. A strong architectural image is essential for originality and may result in spectacular architecture with little or nothing to do with the acoustic function of the building. An example is the Zhuhai Opera House in southern China.



Figure 2 – Exterior Zhuhai Opera House

## 3. THE ROOM ACOUSTICS PROGRAMME

The acoustical design programme is of equal standing with the architectural intentions. The irreducibles as they are understood today, may be summarised:

- musical dynamics/spatial responsiveness,
- clarity and projection
- reverberance and presence
- envelopment
- ensemble.

These take equal place with the architectural image especially in the interior of the space as the team seeks the meeting of minds necessary to produce an integrated architectural and acoustical ensemble. The principal point of difference between architectural and acoustical thinking is that architectural form may be derived metaphorical and to that extent, may be arbitrary. Responsible acoustical innovation must derive from research and is never arbitrary.

If the protagonists for either of these aspects fail to communicate, a meeting of minds is not possible.

## 4. THREE EXAMPLES

For each of the three examples, I intend to detail the acoustical innovation, describe the way it was realised and outline its effect on the architecture.

### 4.1 Christchurch Town Hall (now Douglas Lilburn Auditorium)

Architect: Warren and Mahoney, Acoustician: Harold Marshall

Most will be aware that the Christchurch Town Hall was severely damaged in the earthquake of February 11<sup>th</sup> 2011. This year, 2019 it was fully restored to the City, and reopened almost 8 years to the day after the quake.

The innovation for which it is acoustically well known is the systematic provision of un-masked lateral reflections of the orchestral sound to every seat. The first account of the research on which this provision was based is described in the references (9,10).



Figure 3 – Christchurch Town Hall (Douglas Lilburn Auditorium)

The architectural features to accomplish this are the large interior reflectors for which there was no precedent in the late 60's. It was, and is, a unique architectural interior. An unforeseen acoustical benefit was that these reflectors effectively separated the early sound field from the reverberant field thus permitting clarity and envelopment in the presence of a full reverberation. This room was the first to demonstrate that even in large spaces (seating in excess of 2700) uncompromised multiple uses are possible.

#### 4.2 La Philharmonie de Paris (Salle Pierre Boulez)

Architect: Ateliers Jean Nouvel, Acoustician: Marshall Day Acoustics

In the competition for the design of the Philharmonie de Paris in 2006 - the instructions to the architectural teams explicitly excluded the recognised 'types' of concert hall designs and called for "a new typology" (11). That instruction was composed by a consultant contracted to advise the owner. The winning design was indeed a new typology – the 'bicameral' concert hall, though there had been partial precedents (12). Opened in 2015 the reputation it has amongst musicians, conductors and critics supports the imperative of design originality in form and acoustics.

It is more difficult to identify the specific research which underlay this innovation. It is however a continuation of the theme discovered in Christchurch – to separate the "early" reflections from the reverberant field and to control each separately.



Figure 4 – La Philharmonie de Paris (Salle Pierre Boulez)



The instructions to competing acousticians in the “Programme Acoustique” might well have been a description of the acoustical conditions in Christchurch Town Hall.

In addition, the meticulous shaping of the suspended reflectors using the developments of programs Rhino and Grasshopper, is in direct succession from the Christchurch design 40 years earlier. The formation of the nested spaces to achieve this “bicameral” design needed the successful meeting of architectural and acoustical thinking.

### 4.3 Guangzhou Opera House

Architect: Zaha Hadid Architects, Acoustician: Marshall Day Acoustics (13)

Now we can comprehend also how the Guangzhou Opera interior came into being. There was a meeting of minds (as we always seek) between the architects and ourselves. Within that meeting we have been able to predict the physical metrics of sound in the room to ensure that the objective design guides are fulfilled.

But that is only the denouement to this saga. The actual research starts much earlier. Following the success of the asymmetrical subdivision of the main floor seating in the Orange County Centre for Performing Arts I had been studying asymmetry in halls. A senior student did an asymmetrical opera house design under my supervision. Thus when in Guangzhou it was revealed that the architects intended asymmetry we were ready. But the research went back 20 years.



Figure 5 – Guangzhou Opera interior

Again, we have research-based innovation and another unique space for the Performing Arts.

By way of contrast Marshall Day Acoustics has during the past 2 decades been responsible for some 11 Performing Arts Centres in China. Some of these have had to conform to the “Design Code for Theatre” 剧场建筑设计规范 a Government instruction manual (14). “Theatre” is translated from the Chinese characters as a generic term for a performance space.

A review of the designs is instructive and will be the topic of a further paper.

## 5. CONCLUSIONS

Following a brief review of the principal ‘Types’ of concert hall widely used as the design basis for halls in the second half of the 20<sup>th</sup> century, three examples are offered for innovative designs during this period. The need for change arose partly from the architectural need for novelty and partly in response to manifest shortcomings in the understanding of preference in the sound of the orchestra in concert spaces. In each case there was a research dimension from which the new architectural form emerged. It remains to be seen whether any one of these three will become a new ‘type’ in the 21<sup>st</sup> century.

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